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A Laboratory Guide

of a
Routing Wireless Network
with repeaters

based on
Compex WP54G/WPP54AG

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1. Introduction

This document describes a useful network setup for wireless networks that needs more intelligence than what a simple star topology can offer. The network topology includes one central hub, a wireless repeater and a set of wireless clients.
When mastering this setup, several wireless repeaters and wireless clients can easily be added to a larger scenario.

The network topology is general and can be set up with any brand of access point that can run in Access Point mode (Transparent Bridge) and in Routing mode (Wireless Routing Client).
However, in this document, the Compex WPP54/WP54 series has been used as an example.

2. Hardware

The following hardware is needed:
3 x Compex WPP54AG-6C (incl. PoE injector)
2 x Compex WP54G

2 x PC/laptop with Ethernet interface
1 x router (alt. PC/laptop)
7 x Cat5e Ethernet cable (6 straight, 1 crossed)

Non-mandatory: Internet connectivity

2.1 WPP54AG-6C

The WPP54AG is an outdoor access point that constitutes the backbone infrastructure of the network. One unit is used as the central hub (placed at each Telecenter) and two units are used as a wireless repeater.

2.2 WP54G

The WP65G is an indoor access point that id used as client units. All wireless clients run in routing mode (Wireless Routing Client) to allow routing with internal networks. Clients (users) will request IP addresses from the wireless routing clients via DHCP.

3. Software

The latest version of Firmware for the WPP54AG-6C and WP54G.

Software packages like traceroute and tcpdump are desirable for troubleshooting and a deeper understanding of the setup.

4. Default configuration

Both Compex models come with the same default configuration:

IP address: 192.168.168.1
Password: password

5. Backbone setup

Start by setting up the backbone infrastructure that includes four elements:

1. Border router
2. Central hub
3. Repeater (tow units)

Note that the WPP54AG acting as repeater should be daisy chained using a crossed cable.

See Appendix 1 on how to use the PoE injector for the WPP54AG units.

See Appendix 2 for router configuration and access point configuration.

1. Log into each of the three access points and set the radio and IP settings according to Appendix 2.
2. Make sure that the router can ping the repeater and that the repeater can ping the router.

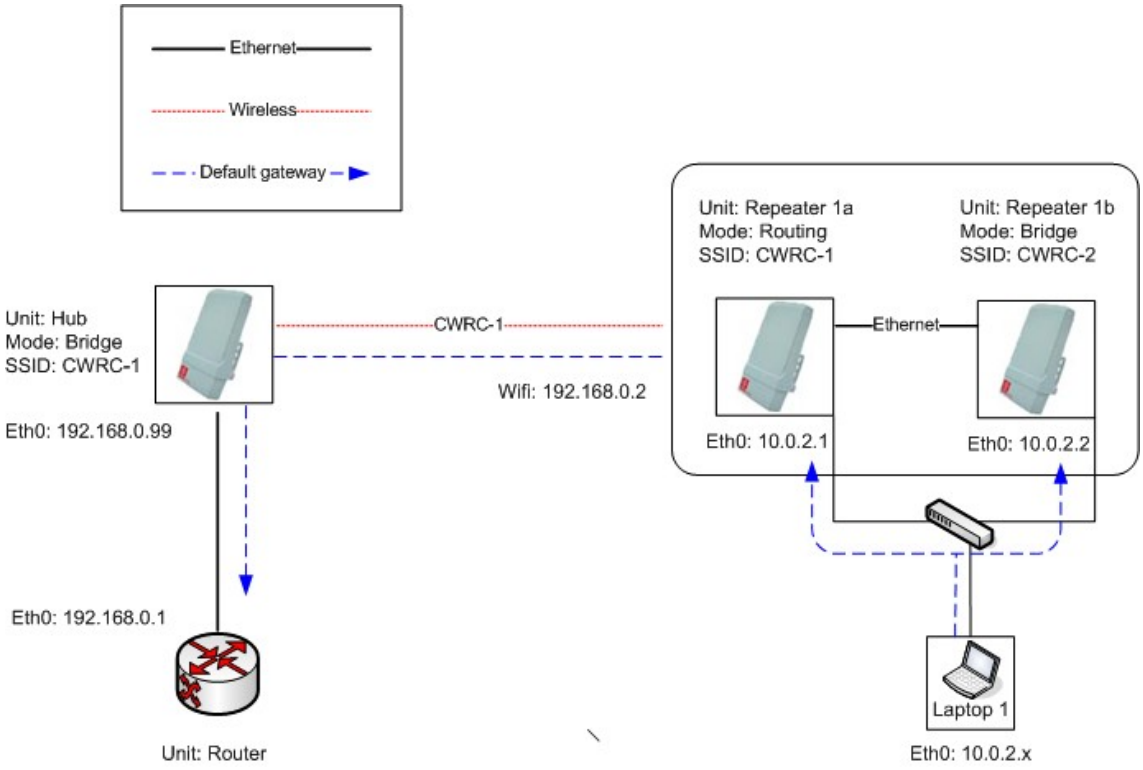

Image 1: Backbone infrastructure consisting of a border router, a central hub and a repeater.

6. Connect client to central hub

1. Power on one wireless client (Client 1) and log into the unit.
2. Follow Appendix 2 for configuration and make sure that the unit is associated to the Central Hub (CWRC-1).

7. Connect client to repeater

3. Power on the second wireless client (Client 2) and log into the unit.
4. Follow Appendix 2 for configuration and make sure that the unit is associated to the repeater (CWRC-2).

8. Testing of the network

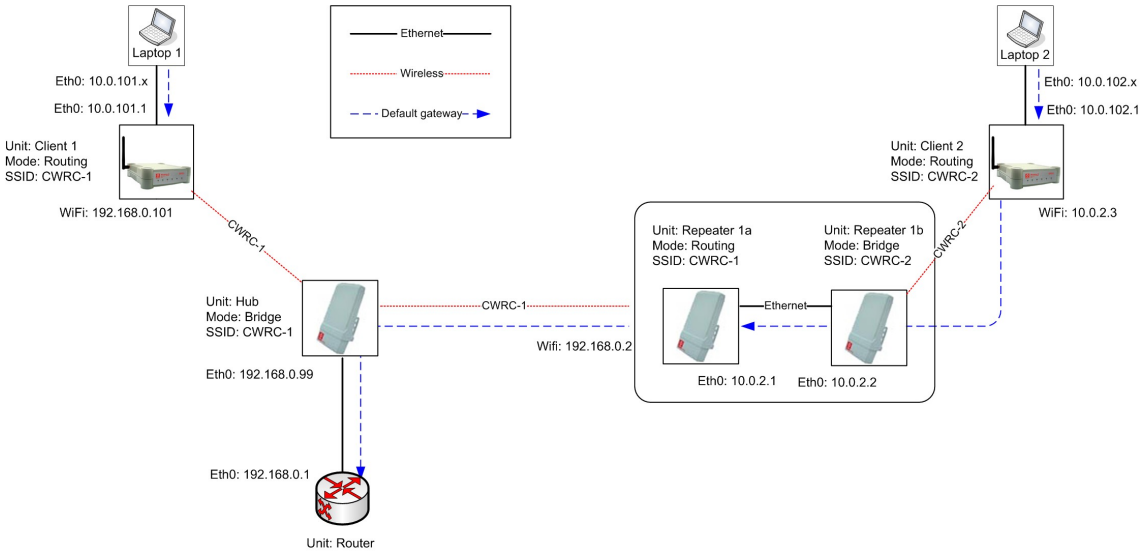

Image 2: Full network topology with two wireless clients connected to the backbone infrastructure.

When the full network topology with IP addresses and routes has been setup according to Image 2, test the network by performing the following Pings using the units built-in Ping utility.

1. Router ping Client 1
2. Router ping Client 2
3. Client 1 ping Router
4. Client 2 ping Router
5. Client 1 ping Client 2
6. Client 2 ping Client 1

Repeat test 1-6 again, this time Pinging to/from the laptops/PC's connected to the clients instead of using the built in Ping Utility of the radios.

From the router, traceroute each client unit (access point or laptop) using the following command:

```
>traceroute 10.0.101.100
>traceroute 10.0.102.100
```

The result should look like the following:

Router to Client 1 (2 hops)

```
> /usr/sbin/traceroute 10.0.101.100 -n
traceroute to 10.0.101.101 (10.0.101.101), 30 hops max, 38 byte
packets
 1  192.168.0.101  45.338 ms  3.391 ms  2.406 ms
 2  10.0.101.100  46.479 ms  2.877 ms  8.559 ms
```

Router to Client 2 (3 hops)

```
> /usr/sbin/traceroute 10.0.102.100 -n
traceroute to 10.0.102.100 (10.0.102.100), 30 hops max, 38 byte
packets
 1  192.168.0.2  43.581 ms  3.839 ms  3.191 ms
 2  10.0.2.3  44.368 ms  5.754 ms  9.126 ms
 3  10.0.102.100  7.482 ms  10.291 ms  6.451 ms
```

Routing table (router)

If you have injected the sub-networks correctly, the following routes will be found in the routing table of the router:

```
>route -n

Destination     Gateway         Genmask         Flags       Iface
10.0.102.0      192.168.0.2     255.255.255.0   UG           eth0
10.0.101.0      192.168.0.101   255.255.255.0   UG           eth0
10.0.2.0        192.168.0.2     255.255.255.0   UG           eth0
192.168.0.0     *               255.255.255.0   U            eth0
```

9. Known Issues

9.1 Remote login to access points

It is not possible to log in to the access points remotely using the wireless interface. Always, the Ethernet interface must be used for administration.

9.2 Firewall

By default, the firewall of the WPP54AG units is *disabled*. Against common sense, a disabled firewall stills blocks the Ping requests. To ensure that ping traffic flows between clients, the firewall must be *enabled* and a concrete rule that *allows all UDP packets to/from all IP addresses* must be created and activated.

10. APPENDIX 1: Compex WPP54AG

10.1 PoE Injector

Use the PoE injector to power on the WPP54AG according to Image 1 (*Out* goes to the access point and *In* to your PC/laptop)

Use LAN1 on the access point to power the unit.
LAN2 is dedicated for daisy chaining.

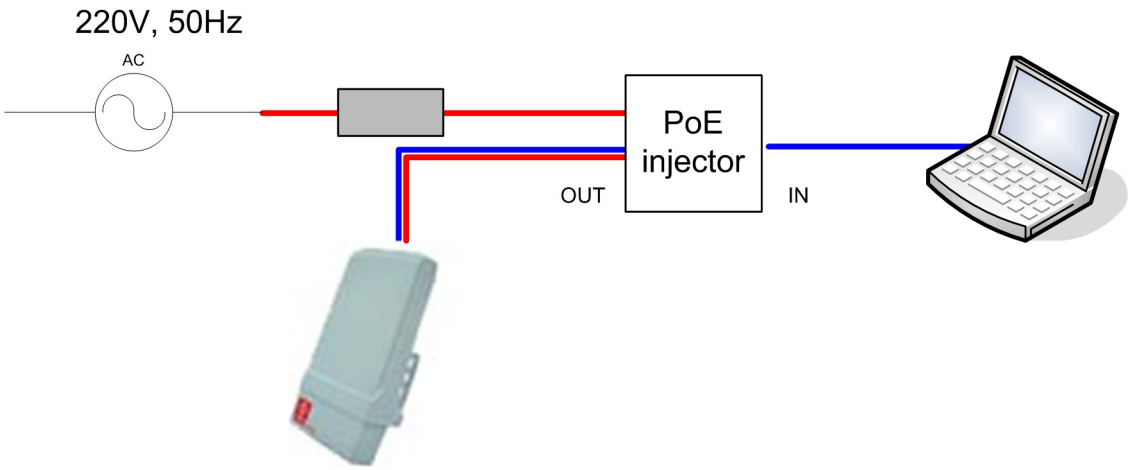

Image 3: How to use the PoE injector with the WPP65AG Compex access point.

The WP54G units comes with normal power supplies.

Do not forget to connect each Compex radio unit to a UPS to ensure a stable source of power. During the boot up process, the equipment is very sensitive to power fluctuations and can get permanently damaged if not powered properly.

WARNING! Firmware corruption can take place if the unit loses power during the first 20 seconds of boot up.

10.2 Reset

To reset the unit to default factory settings, do the following:

1. Press the reset button using a sharp object like a paper clip.
2. The diagnostic LED will start to blink fast. After approx. 5 seconds, the LED will change to blink slowly. Then release the paper clip.

11. APPENDIX 2: Configuration of System Units

11.1 Hub (central)

This unit will be placed in the central tower. Wireless Clients will be connected straight to this unit. Also, one or more wireless repeaters will be connected to this unit.

Mode	Access point (transparent bridge)
SSID	CWRC-1
Channel	1 (perform site survey)
ETH IP	192.168.0.99
DHCP	Disabled

11.2 Repeater

When one or more wireless clients can not connect straight to the central hub, a wireless repeater is needed in order to extend the coverage area of the network.

A repeater consists of two different radios (Repeater 1a, Repeater 1b). The first radio acts as Wireless Routing Client and receives the radio signals from the central hub (or a repeater). The second radio acts as a bridge and relays the radio signals to clients further away.

11.2.1 Repeater 1a

Wireless and IP settings

Mode	Router (Wireless routing client)
SSID	CWRC-1
WIFI IP	192.168.0.2
ETH IP	10.0.2.1
Gateway	192.168.0.1 (router)
DHCP	Disabled
NAT	Disabled

Note that the Wireless IP address and the Gateway are found under WAN Setup.

Routing table

Destination	*Network mask*	*Gateway*
10.0.101.0	255.255.255.0	192.168.0.101
10.0.102.0	255.255.255.0	10.0.2.3

The routes must be added manually in the access point under *Routing*.

11.2.2 Repeater 1b

Mode	Access point (transparent bridge)
SSID	CWRC-2
Channel	4 (perform site survey)
ETH IP	10.0.2.2
DHCP	Disabled

11.3 Clients

Wireless clients can be connected either straight to the central hub or to one of the repeaters (the relaying radio). In this example, we have included two clients where on is connected to the central hub and the other one to the repeater (Repeater 1b).

11.3.1 Client 1

Mode	Router (Wireless routing client)
SSID	CWRC-1
WIFI IP	192.168.0.101
ETH IP	10.0.101.1
Gateway	192.168.0.1 (router)
DHCP	Enabled (10.0.101.100 - 10.0.101.254)
NAT	Disabled

11.3.2 Client 2

Mode	Router (Wireless routing client)
SSID	CWRC-2
WIFI IP	10.0.2.3
ETH IP	10.0.102.1
Gateway	10.0.2.1 (Rep 1a)
DHCP	Enabled (10.0.102.100 - 10.0.102.254)
NAT	Disabled

11.4 Router

A router located between the wireless network and the upstream Internet connection is needed to route the traffic correctly.

ETH IP	192.168.0.1

Routing table

Destination	*Network mask*	*Gateway*
10.0.2.0	255.255.255.0	192.168.0.2
10.0.101.0	255.255.255.0	192.168.0.101
10.0.102.0	255.255.255.0	192.168.0.2

To add the above stated routes to a Linux computer, use the following command:

```
> route add -net 10.0.2.0 netmask 255.255.255.0 gw 192.168.0.2
> route add -net 10.0.101.0 netmask 255.255.255.0 gw 192.168.0.101
> route add -net 10.0.102.0 netmask 255.255.255.0 gw 192.168.0.2
```

Not that every new client network (10.0.x.0) that is added to the network, needs to be injected as above.

Finally, activate the IP forwarding in the kernel:

```
> echo 1 > /proc/sys/net/ipv4/ip_forward
```